ONE AND A HALF CENTURY OF PHONOSURGERY – FROM AN OUTRAGEOUS AUDACITY TO AN ADVANCED STANDARD

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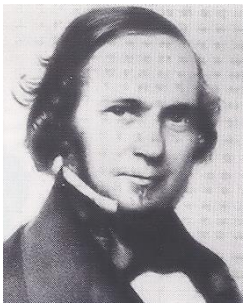
After an unpublished presentation at the
5th International Congress of the World Voice Consortium
with a Satellite Meeting of the Collegium Medicorum Theatri (CoMeT)
Luxor, Egypt, October 27-31, 2012

Pioneers

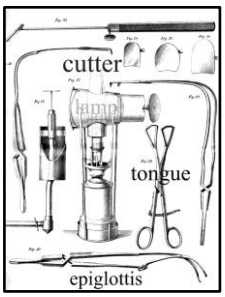


Horace Green, New York, published in 1852, according to the historical overview of Steven Zeitels in Bob Sataloff's big textbook (with an excellent chapter on Voice Surgery by the editor himself) the first report of an excision of a polypoid mass from the laryngeal ventricle area of an 11 years old girl by direct laryngoscopy, using a bent tongue spatula under sunlight.
But, the reason was airway obstruction, not the voice.

It was on Saturday, July 20 1861, that the leading surgeon in Tuebingen, Germany, **Victor von Bruns**, succeeded in removing a polyp from the vocal folds of his brother Theodor, custos at the Royal Library in Berlin. The only symptom he was complaining about was hoarseness. Von Bruns used indirect mirror laryngoscopy which had been introduced just a few years ago by **Ludwig Tuerck** in Vienna and **Johann Nepomuk Czermak** in Pest, Hungary, and only a handful of doctors in Germany may have been capable of using it at that time.

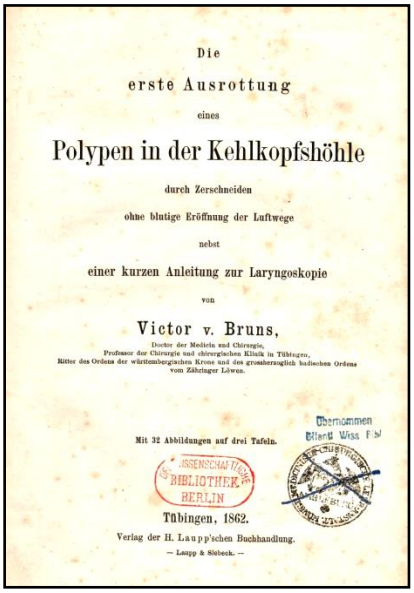

KLINIK
DER
KRANKHEITEN DES KEHLKOPFS
UND DER
ANGRENZENDEN ORGANE
VON
DR. Georg Lewin
Berlin. 1863

One of them was **Georg Lewin**, dermatologist and laryngologist in Berlin who later on, 1863, published about his experiences. He discovered the polyp.



Von Bruns studied the mirror technique thoroughly with Czermak and designed special instruments, quite similar to those still in use to-day, and then, trained his brother as well has himself for several months to overcome the gagging reflex when entering the larynx

without any anesthesia which was not invented, yet. Finally, they succeeded, the polyp was removed and the voice was clear and sonorous.



Die

erste Ausrottung

eines

Polypen in der Kehlkopfshöhle

durch Zerschneiden

ohne blutige Eröffnung der Luftwege

nebst

einer kurzen Anleitung zur Laryngoskopie

von

Victor v. Bruns,

Mit 32 Abbildungen auf drei Tafeln.

Tübingen, 1862.

Verlag der H. Laupp'schen Buchhandlung.

The

First Extermination

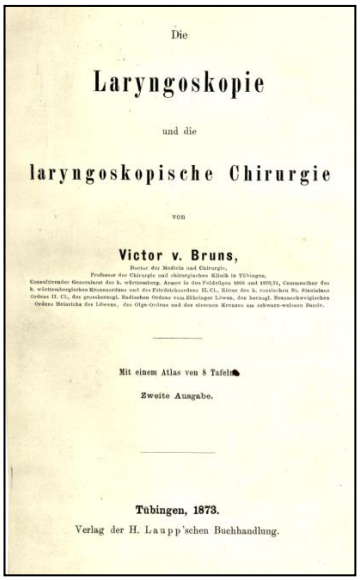
of a

Polyp in the Laryngeal Cavity

by Dissecting

without Bloody Opening of the Airway

Von Bruns contributed significantly toward establishing medical competence in voice disorders. But, his contemporaries were more than skeptic and considered the procedure as "... *an audacity not to be imitated, as for which there would be hardly again a second good reason and an opportunity for its repetition".* Von Bruns was, not at all, put off by these attacks. On the contrary, he continued perseveringly with his "outrageous audacity" and published, 10 years later, based on 28 successfully operated cases more, a huge tome on laryngoscopic surgery with a collection of excellent pictures.



Die

Laryngoskopie

und die

laryngoskopische Chirurgie

von

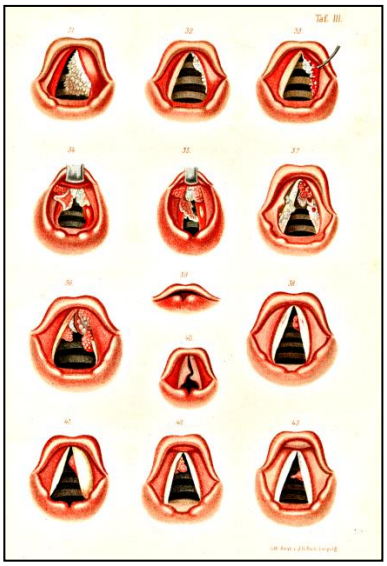
Victor v. Bruns,

Mit einem Atlas von 8 Tafeln

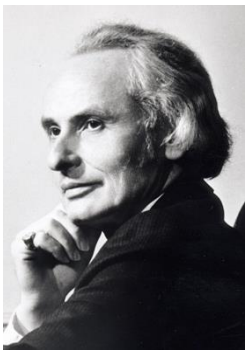
Zweite Ausgabe.

Tübingen, 1873.

Verlag der H. Laupp'schen Buchhandlung.



This was the beginning of phonosurgery.



The term was coined 100 years later by **Hans von Leden**

and **Gottfried Arnold**,

discussing in the bar of the Roosevelt-Hotel in New York after the 68th Annual Meeting of the American Academy of Ophthalmology and Otolaryngology

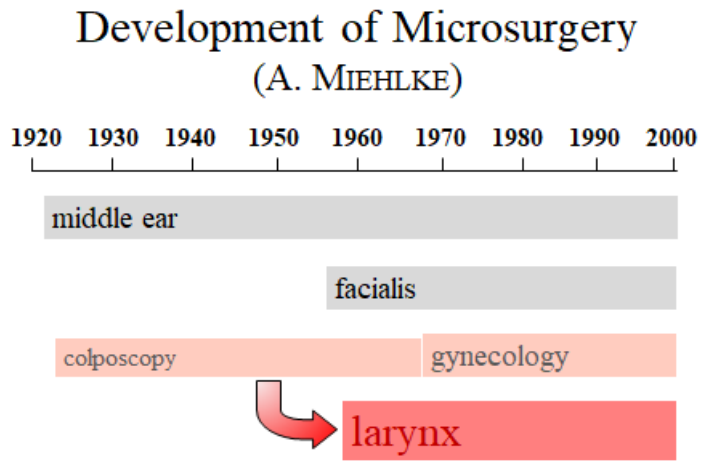
and comprises to-day as to a definition that I had proposed at the 6th meeting of the International Association of Phonosurgeons in Venice / Abano Terme, Italy, 2000
- improvement
- restoration and
- preservation of voice (and speech).

We are, now, going to refer to voice only and to the level of the vocal folds.
The **main methods** can be summarized as
- indirect microsurgery
- direct microsurgery (cold or /and CO_2-LASER)
  . tissue removal
  . augmentation (collagen, fat, teflon)
  . glottoplasties
  . Reinke's space restoration
- framework surgery, thyroplasties
- reconstructive measures after tumor surgery
- (botulinum A toxin injections), provided you might name this little prick a surgical procedure.

As the title of my lecture refers to present day standards, I will leave out Reinke's space restoration, reinnervation, pacing, and tumor surgery, which all are, still, in progress and also object of several special presentations during this congress.

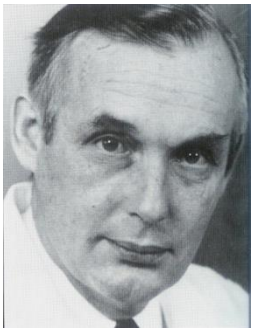
Microsurgery

It goes without saying that most of the procedures are being done under microscopic magnification of the area in view.

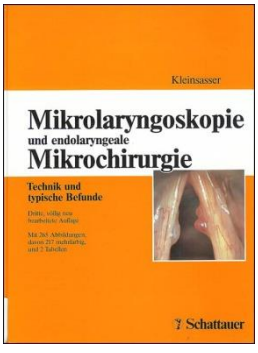


Amazingly enough, to-days microsurgery of the larynx did not emerge from ear or facial surgery, but, from colposcopy and thus from gynecology.

It was **Rosemarie Albrecht** in Erfurt, Germany, **1954**, who took her patients, in cases suspicious of tumor, once in a week to the Gynecological Clinic and used their colposcope by just putting it one level up for a better diagnostic view of the larynx.

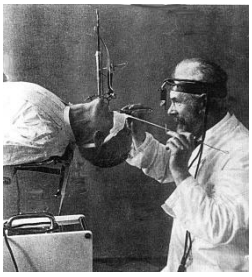


Oskar Kleinsasser, then in Cologne, was thrilled by this approach and made it the basis for his



direct microlaryngoscopy and endolaryngeal microsurgery (1962).

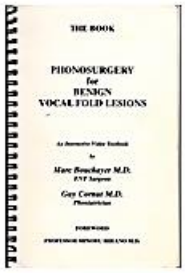
Being a veritable tumor surgeon, he initially did not pay too much attention to the voice, but later on, of course, he did. Kleinsasser's approach was an important step forward and provided considerable comfort both for the doctor and, not to forget, with the general anesthesia, for the patients.



I remember very well the rather unpleasant procedures in topical anesthesia, when we were using **Gustav Killian's** suspension laryngoscopy, a great progress itself, of course, in 1912.

When we are talking about direct laryngeal microsurgery, we should mention one of the great masters in the field, **Marc Bouchayer** from Lyon, France (unfortunately, no portrait found!).

1994



With his excellent interactive instructional video, he has contributed significantly to spreading out knowledge and skill all over the world. In addition, we owe him the discovery of, until then, hidden lesions like mucosal bridges, obviously the reason for quite a number of misdiagnosed "functional dysphonias".

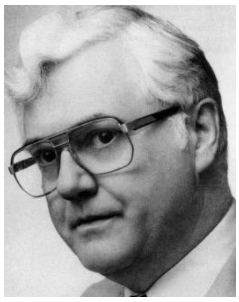
In parallel, we followed **Karel Sedláček**, Prague, who recommended **indirect microscopic surgery** in topical anesthesia for minor benign lesions to the benefit of better functional control of the voice with the patient awake during the operation.

Only one week after a demonstration of his method in 1967, I did my first operation in this way that became our standard from then,

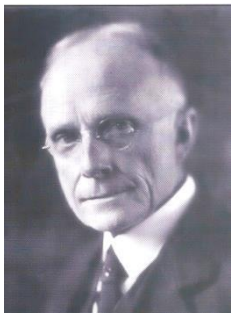
later on (1972), together with
Wolfram Seidner
extended to microstroboscopy and, thus, allowing functional control not only by listening to the sound of the voice, but also by watching carefully the vocal folds vibration whilst the intervention is being carried out, with the patient awake.




We stopped counting the interventions when we had reached some 5000 cases. Several follow-up studies 1 to 5 years after the operations revealed quite satisfying results with a share of normal findings (morphological as well as functional) in the order of 90%. And, particularly convincing, all of our operated singers, among them top international soloists, returned to stage with full vocal efficiency.



By the way and according to Hans von Leden's report in Sataloff's book, **Geza Jako** from Boston, one of the pioneers of American phonosurgery, had tried out indirect microsurgery as early as in the late fifties, but later on concentrated on direct procedures in general anesthesia,



as **Chevallier Jackson** had done before him in Pittsburgh (1915) in local anesthesia and without optical magnification.

Now, let us have a brief look at indirect and direct approaches in terms of a selection of benefits and drawbacks:

Indirect benefits
- functional control
- can be done in an office procedure and provides
- optimal demarcation of small lesions due to the physiologic tonus of the musculature.

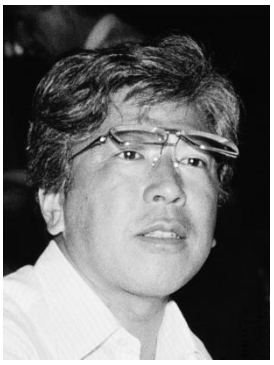
Indirect drawbacks
- patients' cooperation is essential and requires emphatic "psychanesthesia",
- any risk of heavy bleeding stands for a strong contraindication
- and you have just one single hand to work with.

Direct benefits
- direct approach guaranties, of course, reliable control of bleeding,
- and two free hands allow precise preparation,

Direct drawbacks
whilst, on the other hand,
- in-patient treatment is mostly necessary, and
- due to poor demarcation and missing functional control,
- there is a potential risk of overdoing: finally, looks nice, but sounds bad.

Now, regarding the successful establishment of phonosurgery, it must be stressed that the pioneers spent a lot of time and efforts to study the anatomical, histoanatomical, and physiological as well as the acoustic conditions and prerequisites in the field to optimally adapt their surgical procedures. Let me name, just for example, two outstanding representatives: Minoru Hirano from Kurume and Nobuhiko Isshiki from Kyoto.

Minoru Hirano

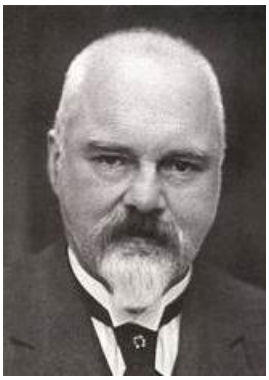


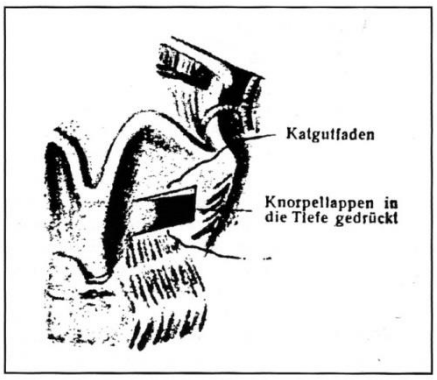
Hirano developed, on the basis of extended studies, the body-cover-theory and, consequently, mucosal wave concepts were assimilated into microsurgical techniques with maximal preservation of the vocal folds' layered microstructure being an essential goal (1975). Infusing a saline epinephrine solution into the superficial lamina propria, as recommended by Zeitels, can be helpful. Hirano brought phonosurgery up to a new level as it is, still, reflected in current international standards.

Nobuhiko Isshiki

The same is true for Isshiki. His name is, among others, closely linked to laryngeal framework surgery (1974). Isshiki has hammered out a systematic program of thyroplasties. Many scholars from all over the world attended his courses and took the master's experience home to the benefit of their patients.

Erwin Payr



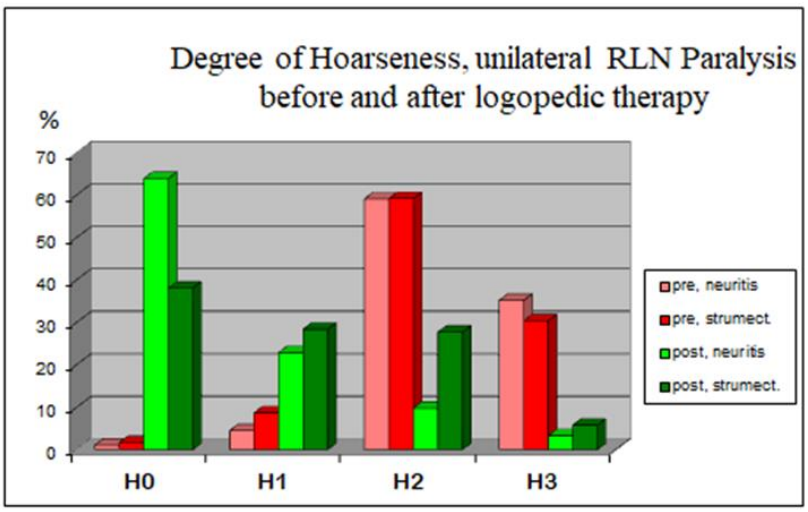


Isshiki took up an ingenious idea of the German military surgeon Erwin Payr from Leipzig who, during the 1rst World War (1915), had medialized a paralyzed vocal fold by impressing a rectangular flap from the thyroid cartilage.

It is my privilege to show you a documentation of Isshiki's first case of arytenoid adduction in 1972 (video).

Logopedic therapy

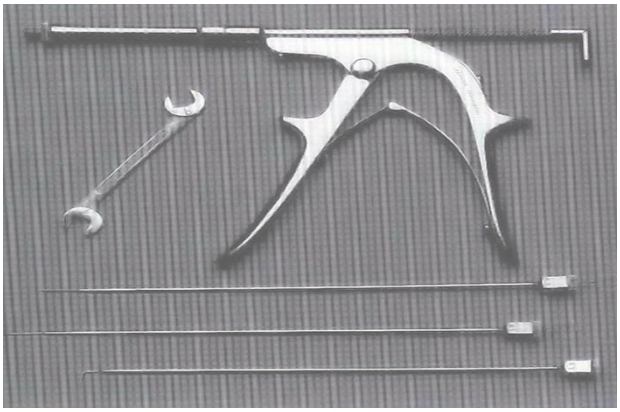
As to the indication of phonosurgical measures in patients with unilateral recurrent laryngeal nerve (RLN) paralysis, you may have a look at the outcome of logopedic therapy only as reflected by the results of a multicentric study of our own based on more than 1000 patients, here broken down to neuritis and strumectomy caused. The red columns stand for pre and don't show considerable differences for both groups regarding degree of hoarseness. The green ones (post) reveal quite good outcomes for neuritis with the nerve's continuity intact and



reflect complete recovery with return of full mobility in most of the cases. After strumectomy, such a recovery is more likely rare. Thus, we find, even after extended logopedic therapy, high and medium degree hoarseness remaining due to persisting incomplete closure summed up to the order of 40%. Here are the candidates for phonosurgery.

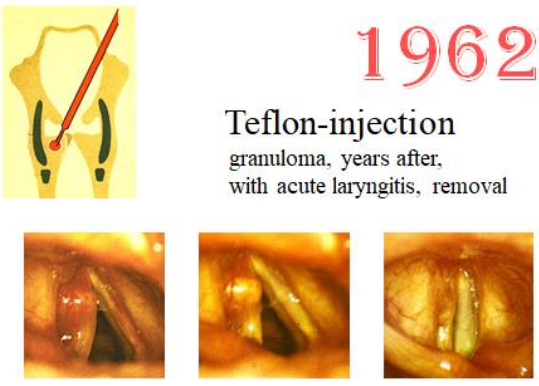
Augmentation, Wilhelm Brünings

4 years before Payr's thyroplasty, Wilhelm Brünings in Jena, Germany, was the first one to use the principle of augmentation to achieve full closure by injecting paraffin into the paralyzed vocal fold. The results were excellent, but, due to the development of a number of paraffinomas, the method became discredited and had to be abandoned,

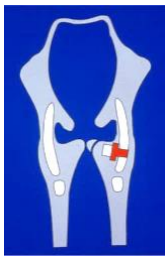


but, the special injector he designed is, still, in use to-day, for instance for augmentation by injection of autologous fat in cases of presbyphonia due to atrophy of the vocalis muscles with quite impressive improvement of the voice (video presbyphonia, fat injection).

Back to unilateral RLN paralysis. Looking for reliably inert material, after trials with Tantalum powder, **Teflon** was recommended by **Arnold** and his group in the early sixties and widely used. And so did we, too, and quite successfully so.



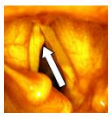
But, in accordance with other reports, we had to realize that, in a few cases, granulomas developed in the course of an acute laryngitis, even years after the application without any reaction before. Of course, they could be removed, but, we decided to stop using Teflon and – as the first ones in Europe, as to my knowledge - to turn our attention to Isshiki's thyroplasty



with the **insertion of a silicone block.**

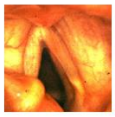
Even here, we had to cope with some problems.

RLN
paralysis r.



dislocation
after TP

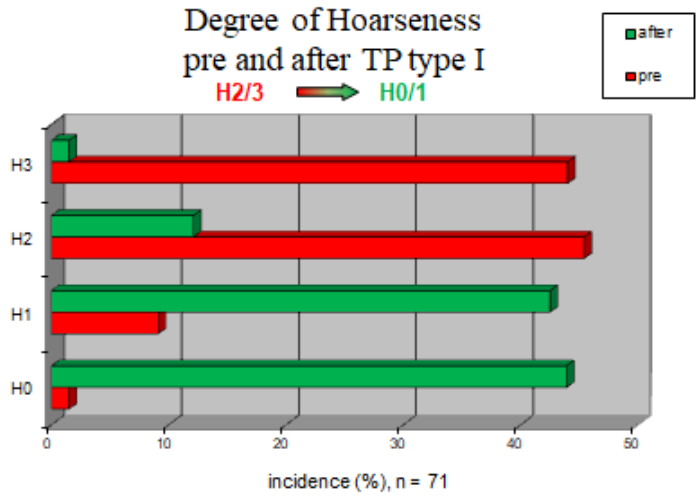
after
LASER
correction



After proper placement of the excised piece of cartilage, it happened that, due to the manipulation with the silicone block, the excised cartilage got out of control and became dislocated, another reason for a second intervention.

That's why we decided to do without the silicone block and use **glue fixation** instead when, under control of the voice, optimal positioning was achieved. (Video)

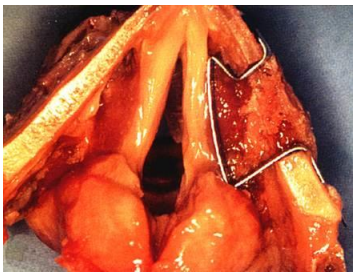
Hoarseness pre – post thyroplasty



Looking at the degree of hoarseness before (red columns) and post TP (green columns), we see that high and medium degree is reversed to none and slight.

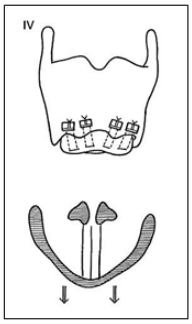
Gerhard Friedrich, Titanium

The dislocation problem was finally sorted out, when Gerhard Friedrich from Graz, Austria, did without the excised cartilage and inserted a titanium clip instead (1999).



Even rather wide gaps can be compensated that way quite well.

Raising Pitch
TP type IV



Thyroplasty, type IV
Isshiki

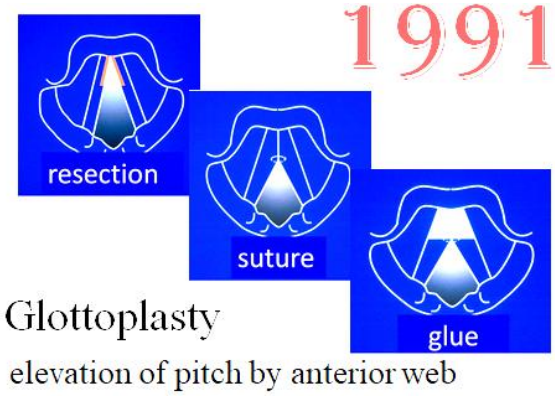
elevation of vocal pitch

stretching
of the vocal folds
by
cricothyroid approximation

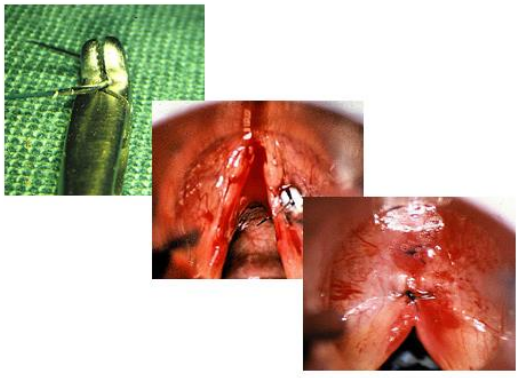
Another type of Isshiki's TP aims at the **elevation of pitch** by cricothyroid (CT) approximation by means of sutures, so that the vocal folds are being passively stretched.

Glottoplasty

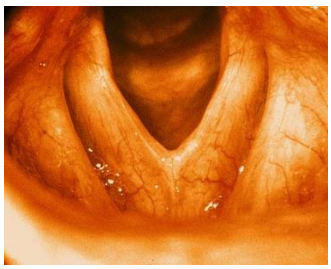
I myself went another way which I called glottoplasty, a structural change by forming an anterior web to shorten the vibrating glottis for lifting up the pitch, as it may be desirable in transsexual cases of male to female adaption.



After resection of the marginal mucosa, the anterior thirds are sutured and additionally protected by fibrin glue.



A special needle forceps is helpful to easily set the sutures.



That is how the glottis looks like after the glottoplasty.

In a short video clip the patient stresses her main problem of having been misidentified before mainly on the phone.

And again, a brief look at benefits and drawbacks of the two approaches:
CT approximation provides good pitch control under local anesthesia and, thus, optimal adjustment. But, pitch may drop down in time due to loss of tissue tension.
In glottoplasty, structural change guarantees permanent change of functions, but, with no pitch control during the intervention (general anesthesia); the result is not reliably predictable.

Spasmodic dysphonia

Spasmodic Dysphonia had continued to pose a challenge to all therapeutic efforts, with heated controversial debate for a whole century, until **Herbert Dedo** (1975) from San Francisco caused a great sensation by a spectacular action: He cut, deliberately, an unhurt, intact recurrent nerve, and very successfully so. The access to the nerve is not so easy and requires detailed anatomic knowledge. Here you see a typical example, showing a long lasting success (video).

Some years later, for the same disease, **Andrew Blitzer** and his group in New York presented another risky venture by injecting a most dangerous poison into laryngeal muscles, **Botulinum toxin**, to-day the basic standard for a symptomatic therapy of dystonias.

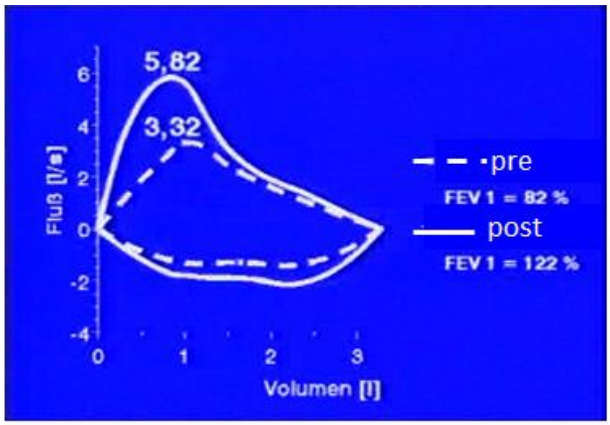
We ourselves did just two nerve sections, primarily very successfully so, but, both with reoccurrences after a couple of years in spite of persisting paralysis. Even then, botulinum, to which we had turned generally mean time, was helpful.

Botulinum in bilateral RLN paralysis

Another application of the toxin might be of interest.

One day, a patient was sent to us after strumectomy for tracheotomy because of severe dyspnea due to **bilateral paralysis** after strumectomy. We found the vocal folds both in paramedian position, EMG of the CT muscles revealed normal activity.

With the classical concept of laryngeal innervation in our minds (which is more than questionable, as we will realize during this congress), we thought that we could achieve a change of position from paramedian to intermediate by injecting botulinum into the CT muscle and, thus, gain a little more glottic space for better ventilation. And, curiously enough, it worked. Breathing was, not at all, luxurious, but, satisfactory enough to avoid tracheotomy, and a couple of months' later, normal respiratory mobility returned (video).



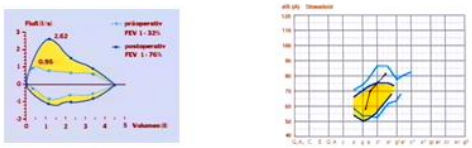
ventilation test

LASER-Arytenoidectomy

For permanent bilateral RLN paralysis with severe breathing problems, we prefer LASER-arytenoidectomy with quite satisfying results for both respiration and phonation in terms of an acceptable compromise.

Here the configuration of the glottis with a posterior chink for breathing and remaining anterior vocal fold tissue for voice production, the gain in air flow and the moderate deterioration of the voice range profile.

LASER-Arytenoidectomy

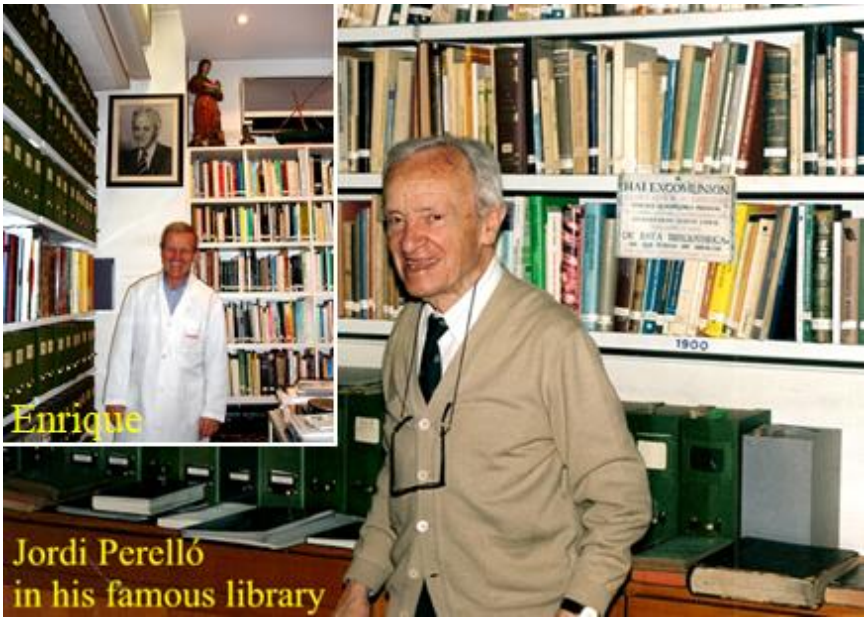


Courtesy of T. Nawka

Special memories

And now, please, allow me some personal remarks related to special memories.

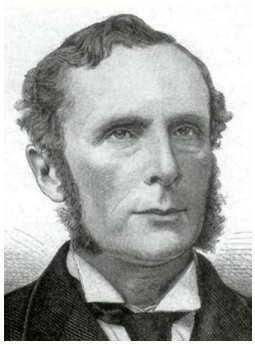
When I came to the ENT-Clinic of Charité Hospital in Berlin in 1969, there were some special histologic specimens kept under lock and key, top secret and confidential: Hitler's vocal fold polyp. During my inquiries in this matter, I came across with an article in Barcelona, where my friend **Jordi Perelló** has had collected the most extensive phoniatric library of the world – mean time even doubled by his son Enrique – fantastic! Here and in other publications is documented that

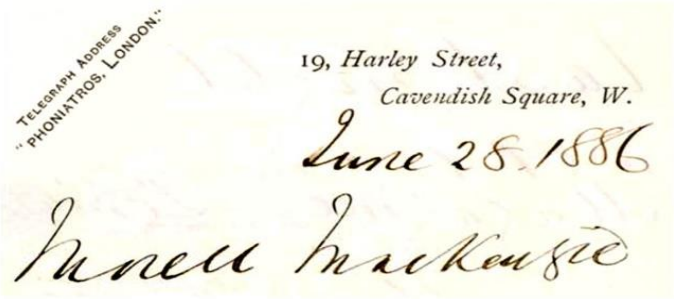


Carl Otto von Eicken,
Director of the Charité ENT Clinic, worldwide held in highest esteem as one of the leading ENT surgeons, removed a polyp from Hitler's larynx at the Reichskanzlei on May 23rd, 1935. Being asked for his fee, von Eicken replied: "It was my honor". Nevertheless, Hitler let send him a sum of 260.000 Reichsmark, not only then a monstrous amount of money. Von Eicken did not take one penny for himself, but, made it a donation to support young scientists of his clinic. Noble and integer.

Hitler was pretty much concerned about his laryngeal disease, because, he knew very well the medical history of the German **Emperor Friedrich III**., a story in which the famous English laryngologist of outstanding merit,

Morell Mackenzie, is involved in a rather ignominious way.





Courtesy of K. Vrtička

This makes us, particularly, unpleasantly affected, considering that the description of our specialty, phoniatrics, is being put down to him, because, for his telegraph, he had chosen the address "phoniatros".

Despite of his unquestionable merits, Mackenzie went down in history also as a rather dubious vassal of the English royals, in particular of crown princess Victoria, with her power struggling for the accession to the German throne for her husband, the Prussian crown prince Friedrich Wilhelm, who suffered from a laryngeal carcinoma and, then, as the so-called 99-days-emperor Friedrich III., died badly in painful agony in 1888. Repeated, obviously incorrect biopsies, misinterpretations in the interest of Victoria, and arrogant rejection of any surgical measures urgently recommended by German authorities characterize Mackenzie's behavior in this tragic episode.

Von Eicken and Mackenzie, two extremely contrasting personalities in laryngology.

Voice ideals

What we have used to call an ideal voice (clear, pleasant, sonorous) is going to be replaced in the public perception by hoarse and harsh professional voices (in singing as well as speaking) more and more, be they really pathologic or arbitrarily maltreated.

We have to realize that these voices are not only generally accepted, but, even are attracting special interest. Thus, outstanding artists are cultivating their hoarse voices as a typical "image brand" which they are anxious to be kept even when they urgently are asking for therapy because of complete vocal break down: "doctor, make my voice strong and powerful again, but don't you make it clear or smooth".

Not so easy!

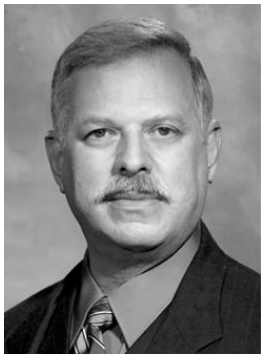
I have got a special example for you. An actress and director of high international reputation, known for her somewhat "smoky" voice,

came to my office with rather huge Reinke's edemas, nearly aphonic after only a few minutes of speaking. "Help me, but keep my vocal identity".
I tried to leave a little bit more of the mucosa as usual, I was lucky, and she was happy. (Video)

And even more impressive:
In the 60s, a young actor and singer came to see me, complaining of "voice problems". After carefully testing his vocal performance and thorough investigation of his larynx, I told him, that I cannot see any problem; on the contrary, I found a very strong and powerful voice, sonorous and pleasant.
"But that is, exactly, the problem. My voice is too nice, too beautiful; can't you make it hoarse to the benefit of my career?"
Quite frankly: I refused this implausible request and encouraged the likable young man to make best use of his excellent vocal material.
Shortly after that visit, he escaped from East Berlin to Western Germany

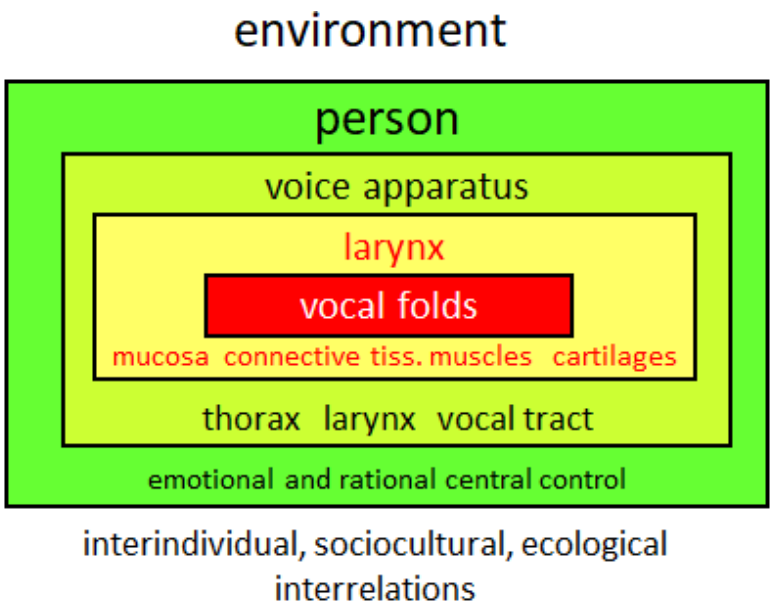
and went to my friend **Gerhard Kittel** in Erlangen (who told me the story many years later) with the same request and the same negative reply.
How things went on? Well, the young man went to Hollywood, and, very soon, became an international top musical star, despite of his, ironically enough, or because of his healthy voice - who knows. The well-known artist is, still, active on stage and in movies, and very successfully so.

Concluding remarks
The title of my presentation claims phonosurgery to be a standard to-day. If this is true, we should meet that field as a ubiquitous topic, for instance, on the web. And in fact, that's how it is. Most of the ENT-Clinics worldwide offer phonosurgical service and quite a number of organizations have made it an important issue of their programs and meetings, as for instance The Voice



Foundation with **Robert Sataloff** as one of the internationally leading phonosurgeons.
This is also true for, of course, the International Association of Phonosurgeons, for CoMeT, the UEP, the Pacific Voice & Speech Foundation, the World Voice Consortium, the European Laryngological Society, the Paneuropean Voice Conference, and in addition, numerous regional postgraduate courses are available.

I am sure that all of you will agree that voice production has to be looked at as a highly complex, multidimensional process:



- lots of environmental conditions are continuously influencing this process
- going on within a person
- psychonervally controlling a sophisticated anatomical apparatus
- with the larynx in its center
- containing, finally, the vocal folds as the sound generating structures.

All these aspects have to be considered carefully in any voice therapy.
We have to be aware that, with phonosurgery, we are concentrating on just a very tiny element of voice production and thus, we are back to the 19th century, back to a – we must confess - a rather mechanic, even mechanistic approach to the process of voice production. The only reason that justifies such an old fashioned philosophy as an advanced standard is: it works.

Dedicated to the thoughtful host of the Luxor meeting in 2012,
Prof. M. Nasser Kotby, M.D., M.Ch., FRCS

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